

CARD STORAGE SYSTEM AND TIME
PUNCHING MACHINE

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INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY
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**card storage system and time
punching machine**

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Approval sheet

Diploma project entitled 'Design of Cards Storage System and Time Punching Machine' by B. Kalra is approved for the postgraduate diploma in Industrial Design.

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All technical staff and my friends.

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1. Problem Statement :

To redesign the 'Card Storage System and the Time Punching Machine' in otherwords to redesign a device which is to be used to record the workmen arrival at and departure from work place, a provision to keep these records and to make the system more efficient

I. D. C. Library
L. I. T. Bombay.

2. Introduction :

Seventeenth century has added a chapter of industrial revolution to the history. Since then more and more rules and regulations have been constituted for the hire of the labour and the remuneration of workers. Various combinations of methods of remuneration of workers have been endeavoured to discover a satisfactory one which would be acceptable to the employer and adequate for the workers to suit a particular type of industry.

One of the oldest methods in existence of remunerating workers is 'Time Work Method', is also referred to as 'Day Work', 'Day Rate' 'Time Rate' etc. By this method the worker is paid a stated sum per day of 8, 9 or more hours, or per week of 40-48 hours and upwards in accordance with the custom prevailing in the particular industry. The general prevalence of this system of remuneration may be attributed chiefly to its simplicity as regards calculation of wages etc. On modern practice, however, this method is modified by introduction of various bonus schemes. In fact the institution of schemes embracing a monetary incentive towards increased production has resulted in a considerable increase

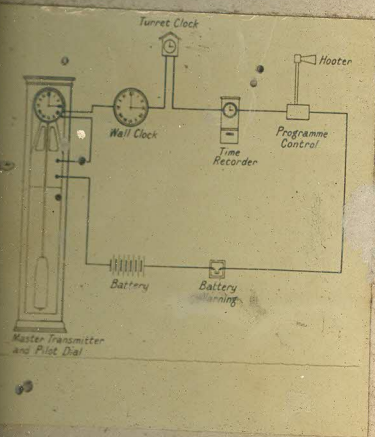
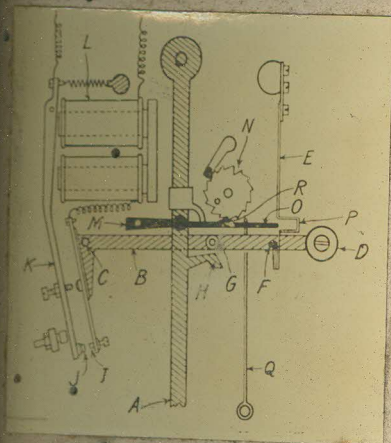
in production, with a consequent benefit to the employer and employee. Hence this method is adopted by the maximum number of industries and still going stronger and stronger.

In time work method, the first essential is the ascertainment of the total time spent inside the factory, etc for which the worker is entitled to draw wages. The three chief methods of recording workmen's time are manual recording, check or disc method and the time recording clock method. The manual system is oldest system and still in use mostly in small industries. The disc method which is superior to the manual system is gradually falling in disuse. The time recording clock method is becoming more and more popular. The device used for recording workman's time is a Time Punching Machine. The existing time punching machine has got good scope of development and improvement a redesign of it is sure to receive a warm welcome.

3. Information :

3.1 Types

3.1.1 There are various types of time recording clocks in general use and they may be broadly classified into, (i) Card time recorders and (ii) Miscellaneous time recorders, which record the times on a roll or sheet inside the clock e.g. key time recorders and radial or dial time-recorders. But in India card time recorders are quite common. The general available varieties of time punching machine are hand lever operated or card insert-pushed operated. The basic clock is pendulum controlled, the drive is given by a spring, which is wound periodically. The winding in the most cases in available clock is mechanical, type as they card is punched the spring gets winded, eighty stamping keeps the clock running for about two days. Some clocks are run by battery or electricity. A big organisations need more clocks to be located at different gates makes the use of a master clock which run a number of the secondary clocks. The clocks display the time on dial or the means of digits. A modified type of the time recording clocks which are used for 'Job recording' purpose are called as Job



recording clocks.

The different makes of the time recording clocks sold in market are manufactured by gravity electric clocks under the brand name of Krishna Watch Industrial Clocks Company. Anglo Swiss time recording clocks are marketed by Eastern Watch Company. These selling companies are in Bombay. Abrecht and Co. clocks are German made, these are distributed by Premier Watch Co., Delhi. There are many other foreign made clock in use.

TOTAL TIME									
DAYS	HOURS	REGULAR TIME		RATE		RS.		NP.	
		REGULAR TIME	..						
		OVERTIME	..						
		EXTRAS	..						
		LOST TIME	..						
TOTAL									

Only Clock Stamping will be recognised.

DATE	IN	OUT	IN	OUT	Interruption		TOTAL	
					OUT	IN	Ord. Time	Over Time
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								

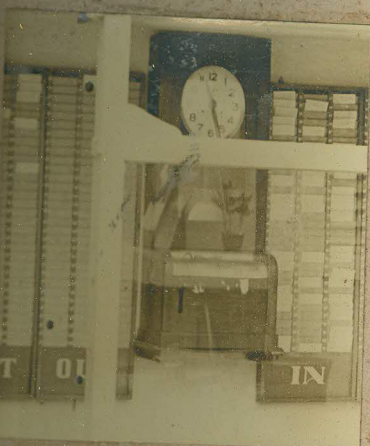
Ms. Polestar Electronics Pvt. Ltd.
Kandivli Industrial Estate, Kandivli West, BOMBAY-67.

3.1.2 There are different types and sizes of cards varying from clock to clock. The width depends upon the inserting opening, the depth on card loading platform for various days. These vary in the thickness too. The different cards communicate different information.

3.1.3 The types of racks used are open type and closed type. These are either fabricated out of sheet or made out of the soft wood. These are readymade, available for the capacity 25 cards and 50 cards unit and then the combinations of these. These racks are always in pairs on 'IN' and 'OUT'.

3.2 Price and Sale :

3.2.1 The time recording clock made by Krishna Watch Co. cost Rs.3150/- single coloured ribbon and Rs.3400/- for double coloured ribbon plus packing forwarding, sales tax extra. Abrecht time recorder clock cost Rs.5000/- including all the charges. These are sold through distributors and regional sales agents.



3.2.2 The cost of the card varies from card to card depending upon its quality, the thickness and size etc. The saling agents of the time punching machine also sale the cards at the rate of 1000 cards. They print out the name of the company etc. if desired. The average quality of the card costs Rs.45/- per thousand. The IBM card which is used for data processing in order to calculate remuneration cost Rs.50/- per thousand.

3.2.3 As a matter of common practice the racks for storing the cards are also supplied by the same sales agents. The racks of different makes differ in cost and the price changes varies with the size of the rack. For example the wooden rack with metal compartment for the holding capacity of

25 cards	Rs. 90
50 cards	Rs.125
100 cards	Rs.175
200 cards	Rs.245
250 cards	Rs.325

3.3 Location :

3.3.1 The time punching machine is located at the gate on a side and near to the security man's cabin or just at the entrance of the plant or shade. Generally it is situated near to the time office and it is under constant watch of the security man or time office people. Still the location of the time punching machine varies from industry to industry.

3.3.2 The cards are always located in the appropriate pockets except when the time office people are using for the muster roll entry purpose.

3.3.3 The cards racks have the permanent place the either sides of the time punching machine. The 'In' racks on the side away from the entrance or which leads inwards the plant and the 'Out' racks on the side which leads outwards of the plant.

3.5.2 The cards are changed every month for the manual methods of calculations etc. whilst the data processing typed cards are replaced weekly. In case if any cards is lost due to any reason or got spoil, it is changed. When the new card issued the number and the name of the employee is filled in.

3.5.3 The racks are dusted off daily. The wooden racks are polished or painted every 2 to 4 years and the little bit of repairing of the hinges and the latches is done whenever necessary. After polishing or painting the numbers on the racks are rewritten.

3.4. Installation :

3.4.1 The mechanical spring wound machine need no wiring etc. This is screwed down or nail down to a strong wall and the bottom is supported on cantilevered mild steel frame work or any stool or wooden frame of suitable height. But for the electrically or battery operated or in case master clock circuit the wiring is done from supply to the clock.

3.4.2 The factory or workshop where the time punching machine used, every employee is given a number called card number, box number or pocket number and correspondingly a card is issued to an employee which are to be stored in the respective pockets for the daily use of employee and time office. At the end of the month in place of the old card a new card is inserted in the pocket. The data processing time cards are changed weekly.

3.4.3 Generally the card racks have one or two hooks by means of these hooks, the racks are hung on the wall using big nails.

3.5 Maintenance :

3.5.1 The time punching machine needs periodical, oiling and cleaning for better life and more reliability. The manufacturers offer the maintenance services of weekly, fortnight in certain regions like Bombay on the retainer-ship of yearly basis. Otherwise also in event of the failure the service-centre is communicated and the service-man come and repair the faults. In case of the major faults the time punching machine is taken to the centre with a temporary substitute. For some companies their maintenance people look after the machine. The ribbon tape is changed after every three month on the average or depending upon the use. The batteries are replaced when it gets exhausted. Some times these clocks are adjusted whenever their time deviates from the standard time. For winter and summer seasons the pendulum length is adjusted as per the requirements. The cabinet is painted or polished periodically.

3.6 Buyer's demand :

3.6.1 The time punching manufacturer are few. The scope of the choice of selection is little. The buyers are from small to medium to big industries. The buyer in the most cases is a purchase officer of the industry. There is no bargain on the cost. The buyers seek for the reliability of the functioning and post services and repairing etc. As a practice a guarantee of one year to two years is granted.

3.6.2 The different industries need different items and instructions to be entered on their cards so they get their ^{cards} printed, once the block is made, it could be used for re-printing. Some industries purchase the cards from manufacturer who can print the name of the customer's ~~name~~ on the card and sales at no extra cost.

The organisations who use the data processing machines for accounting the salaries demand for the specific card which could be fed to the machine for calculations purpose.

3.6.3 The buyers just accept the racks which are available in the market generally from the manufacturers itself. Some industries get their own fabricated racks.

4. Analysis :

4.1 Need analysis

4.1.1 Primary need

Time punching machine: Recording information

Cards: Storing information

Racks: Storing cards

4.1.2 Secondary need

Time punching machine: Communicating information
Protecting mechanism

Cards: Communicating information

Racks: Protecting cards;

Communicating information.

4.2 · User

4.2.1 The employee who punches the card is direct user. The other users are maintenance people, the time office and the everyone who uses the clock for knowing time etc.

4.2.2 The cards are used by the employee and time office and accounting people as in case of data processing cards.

4.2.3 The racks are used by the employee as well as the time office or accounting people.

4.3 Structural analysis :



The time punching machines which is used by minimum hundred and odd small, medium and big industries in only Bombay itself; sponsored by Krishna Watch house under the name of Krishna watch has been taken up for the detailed analysis. The cards and cards racks are also of the same company which are taken up for detailed analysis.

4.3.1 The time punching machine may be regarded as a constitute of two parts the clock division and the printing division. Both of these are put inside a wooden cabinet which is facricated out of a seasoned teak wood. The outlook of the time punching machine resembles very much with a mini-dressing table. The glass panel in the vertical plane and printing division is in place of drawers.

The dimensions of the clock are:

Hight	97 cm
Width, base	43 cm.
Width, top	41 cm
Depth, base	27 cm

Depth, top . . . 12 cm

Weight approx. . . . 28 kgs. . . .

It is evident that the time punching is very huge in size and very heavy in weight when it is compared with the actual size and weight of the printing mechanism as we will see later.

This is difficult and costly for packaging and transportation. The installation also need to be done firmly and strongly. The handling, in event of major break downs when the punching machine is taken to the repairing shop becomes cumbersome. It looks giant and bulky. The upper portion contains the clock and the lower one the printing mechanism.

The upper half has got a big glass panel with a semicircular arc on the top, which depicts the dial and the pendulum being oscillating from side to side and metallic rod going across from the top half to lower half. This sort of panel creates the feeling as if the dial is hanging in air. The oscillation of the full length of pendulum which could be barely seen creates a visual disturbance to the viewer so the communication of the clock that it runs is distracting the attention.

The metallic rod going across the face is very much disturbing visually an absolutely unnecessary.



ssary display put on show. The big empty space left for the pendulum gives a feeling of emptiness in the mind of an onlooker.

4.3.1.1 Clock: The clock has a dial of 24 cm with black number on a white back ground these range from 1 to 12. These numbers are quite prominent and could be comfortably read from the distance of 12'-15' by an average eye sighted man. This has graduations of 1 minute marks enclosed circles and every fifth marks is thickened. This dial displays irrelevant information like logo and the name also causes visual disturbance.

The pointer has typical blade which suddenly shrink in width as it approaches the center. The long tails which over shoots are disturbing elements. The black circle although it attracts to concentrate the attention at the centre, is not necessary. This adds to the printing work.

The dial is circumscribed by shining metallic ring which serves as a demarkation line between the clock and the cabinet. But the lower

half is too prominent and creates a visual unbalance of the clock.

The drive unit for the dial is a compact unit and enclosed in a frame which is screwed to the cabinets. The clock has a long pendulum of app. 30 cm. The link is of wood and the bob is of metal pressed disc. There is a provision to adjust the height. It is assumed that pendulum clocks are accurate. But now fairly good accuracy is obtainable with escapement mechanism and balance wheel type clocks.

There is a long shaft at the ends of which a pair of spur gears are mounted. This serves as a link between the clock mechanism and print mechanism for power transmission.

The clock does not require for its running, either winding or electric power supply if a minimum of approximate eighty stampings are recorded as the clock rewinds itself automatically for about two days. The rewinding mechanism then disengages preventing possible over winding. This feature keeps the clock running without much attention. But in event of strikes or lockout this fails as the minimum stampings are not printed. Otherwise the handle should be operated at the average of 40 times a day to keep the clock running.



This operation is troublesome and there is the wastage of tape ribbon.

4.3.1.2 The printing mechanism is mainly consist of a drive assembly, printing drum, tape ribbon drive, printing lever. The other main accessories are card positioner and the shifter for the same.

The drive assembly is the group of gears, cams and links suitably arranged to drive the printing drum. Here the printing itself winds up the spring.

Printing drum: These are circular rings on the outer rim of there is projections of the hours, minutes etc. in the form of mirror image. These are suitably inter connected and allow the printing to be done in synchronisation with the clock. These rims are covered with the tape ribbon.

Tape ribbon is either single coloured or double coloured and varies in width from 1" to 1-1/2". As the card is punched the tape unwinds from one roll, creeps over the drum and get wounded

on second roll in steps.

Printing lever is a rectangular cross-section of cast iron ~~lever~~ projecting out of the printing division. This is used as a handle and pressed down to print the card. There is a spring which pulls it back to its original position. The size of the projected portion of handle is 10 x 2.5 x 0.5 cm.



The card positioner is a narrow frame block, situated on the top of the printing mechanism. This serves as a guide when the card is fed for printing position. A rider on this indicates the relative position of 'In' and 'Out' on an aluminium anodised plate. A hook type lever is connected to the card positioner and it is spring loaded. By pulling this hook the card positioner could be slid laterally. This serves as a lock.



This full printing mechanism is fixed on the base plank and enclosed in the cupboard type closed space with a metallic top. The card positioner is mounted on this and printing lever is projecting from the front. The sides also could be opened till half width due to hinge arrangements.

4.3.2 The Krishna Watch's card is in rectangular shape 17.4 cm. in length and 9 cm in width and the thickness is about 0.05 mm. The two sides of the clock are in black and red prints. There are eight columns namely date, in, out - three pairs and total time. There are 16 rows on each side with dates printed on it. There is a provision for writing no, name etc. There is a underlined instruction that 'only clock stamping will be recognised No.5'. The most of the industry issue different coloured cards to temporary and permanent employees.

The three pairs of 'In' and 'Out' are not necessary because there would be rare cases when the employee would go out and come in three times in a day's duty unless and until he is on outdoor duty. Generally for such employee a separate report is written or recorded. Even the two pairs are not utilised by most of the companies. The second pair is need by some companies those who do not have appropriate cafeteria facilities the employee need ^{to} going out of the premises or ^{if} employee's house is near about and he goes home for lunch.

The special instruction serves little as it becomes obvious to use the time punching machine unless it goes out of order and if the time punching machine is not substituted the
in order

only alternative means is to be restarted.

This generally would be hand written but may be a rubber stamp and sign.

The two coloured printing is also has little meaning when dates are printed. For the completely illiterate people the front and back side still be differentiated by some other means like printing industries name on one side only.

4.3.3 The card storing racks are closing type and could be locked if needed. The two halves are of capacity of 100 cards each. These are divided in four columns to hold 25 cards in each column. The two vertical wooden strips are grooved at a suitable angle in which a tin plate is slid off to make one pocket. In which a card can be accommodated. These plates are oil painted and the racks are French polished. On the left strip a number is written in white enamel paint.

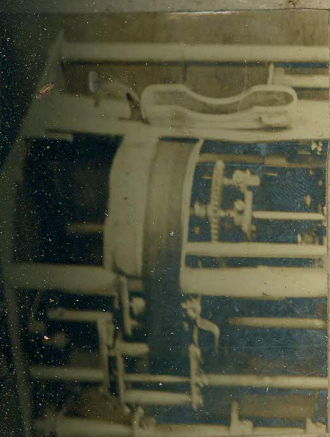
Suppose the company has 100 employee, in that case there would be 1 to 100 on 'In' rack and

same on 'out' rack. Suppose the man power is 200 then a rack will have 1-200 numbers and placed at 'In' side and similar one on 'Out' side. Thus the capacity depends upon the man power.

Normally the card 'In' and 'Out' is not written on the racks by the manufacturers so the user writes himself as per his requirement. Some user do not take little trouble of writing so these are left blank.

4.4 Functional analysis :

It is proposed in first place to indicate the procedure adopted in card time recording system by which the workmen's times are recorded upon separate cards. The cards are arranged in the rack in numerical order by the Time-keeper or Time-clerk. As the workman enters the works he takes out the card bearing his number, goes close to the time punching machine. He holds the card in right hand and inserts his card in the slot of card positioner. It is customary to check the position is 'In', if once set the following workman need not check. Then he presses a lever on the front of the printing unit with the left hand. The hammer linked to the lever strikes the card from behind, the tape ribbon is in between the card and the printing drum and a printing impression of the time indicated by the clock is got on the card in hours and minutes in appropriate place. The hammering stroke gives a feed back that printing is done and this informs the watchman etc. that workman has printed one card and he can have check on the workman's malpractice without keen observation. He withdraws the card walks towards the 'In' racks and places his card in the appropriately numbered receptacle





in the card rack kept on the other side of the clock. When the workman leaves the works, he reverses the operation, taking the card from the 'In' rack, in which it was placed on entering the works, stamping his time of leaving on the card, and then placing it in the rack from which he took it on entering the works.



But this time the card positioner was shifted to out position to carry out the printing in the 'Out column'. The depth of feed to reach the date is once adjusted then it automatically adjusted for following dates.

The complete illiterate employee find their own ways like giving some mark, coloured spot and remembering the exact location etc. Generally every employee is inspected of his belongings when they leave the workplace.



4.4.1 The time punching machine is used by the workman alone as a direct user. But the clock is used as a synchroniser with printing as well as a time measuring device and the time is displayed on dial. The dial has got fairly legible numbers from 1 to 12 but 13 to 24 are not readable unless it is seen from a

initial viz, M-Monday, Tu-Tuesday and so on. This would help in calculations of over time etc. as there are different rate of remuneration for Sundays and holidays in some companies Saturday also where there is five days a week of service.

As there is always some allowances for late coming due to the generosity of the employer but yet everybody is expected to come in time. The deviation of five minutes to ten minutes is tolerated and as an ^{maximum limit} ~~extreme~~ case of half an hour and the deduction is done. Beyond this limit no employee is allowed to attend the duty unless in extreme cases and prior permission. Generally the deduction upto half an hour is accounted.

4.4.2 The main uses of the cards other than the workman are time office and account people. After the punched card left 'In' pockets by the workman, say if the first shift the time office people come and takes the cards and goes to the time office there he checks everybody's card late comers etc., registers their

attendance in the muster roll. Fills up absent mark, leave or casual leave etc. in the card for the previous days whatever the case may be. The cards are replaced back in 'In' racks for the workman. In case of any card is lost the time office makes note of it and replaces it. The card should be good enough to last a week/a month. Where the printing is done by inserting and pushing the card, the card need to be enough strong to overcome the opposing forces.

When the number is quite prominent it is easier to ditact the card and faster the punching cycle. As the card is used by the workman to scrutinise for himself his last month's attendance, over time, deduction time and remuneration, a Employee's State Insurance Corporation (E.S.I.C.) deduction, income tax deduction, etc. In case if there is any idscripancy it is rectified before the payment is done.

4.4.3 The cards racks support the cards and protect these. The number written on the pockets need to be of good legibility for reading.



4.5 Ergonomical analysis :

The location of the time punching machine is one of the most important factor for the smooth operation. The common entrance and exit which is accessible to most of the department or a place near to the gate is suitable. As far as possible the approach to the time punching machine is desired to be at a single level ground for the persons standing in que would be hardly seeing the floor where one is going to step on. To avoid the slipping etc. and as a safety measure it is necessary.



The place should have a well defined roof to protect the user from rain specially and to provide him a shade. . The hight of installation is critical. A convenient of 95 percentile should be considered. The card positioning slot should be just below the chest hight.

4.5.1 clock

The card positioner should have a slot in which the card may be very conveniently inserted. The top edge of the slot touches the finger when the card is inserted to print in the first row. It has a straight edge.

The shifting mechanism for card positioner is



very difficult to be used. The spring tension is too much and the operation is of a single finger. The thin section of the device causes stress on the finger. The operation pull and then slid is difficult as the pull is against a tight spring and then sliding is to be done with the pull of a single finger.



The printing lever is merely a rectangular cross-sectional rod, it is to be pressed down with the left hand. It has no grip at all. The tensioning spring is also tight. To operate this and insert the card the operator has to come to close then if it is mounted on a table, it prevents the worker to have free movement.

4.5.2 The card although does not slips off from the grip of two fingers and the thumb but yet it has no provision for any grip. The top edge where the number and name is written gets dirty. If this is happened to be written in ink a wet hand say due to any reason sweat, rain or water etc. will spoil it.

The card has sharp corners which does not favour the insertion of the card to the punching machine as well as in card racks.



4.5.3 Quite often it has been observed the card racks are hung high. The top most pocket is reached by the fairly tall man also with some difficulty. For this the 95 percentile should be considered. The top edge of the pocket is a flat one and does not promote the inserting of the card in it. The numbers are small and could be hardly read from the distance of 5 feet approximately.

The communication of the letters one to twelve of the clock is okay but thirteen which are of hardly in use have very poor readability due to the size and orientation besides that these are disappearing with minutes/graduation marks. Enclosing circles of minutes/graduation marks results in poorer communication. The irrelevant information the logo etc. the small circle at the centre and over shot tails cause distraction to the viewer.

The big glass panel barely shows the full length

of the pendulum which causes the visual distraction. The connecting rod which serves as a link between clock mechanism and print mechanism also a very distractive element.

The card is cluttered with lines. The pairs of 'In' and 'Out' columns the special instruction 'Only clock stamping will be recognised No.5'. Enclosed between two thick lines is very much dominating over the more important data the time prints, number, name etc. Here the number is required to be most prominent.

It is a favourable to see there is a proper illumination in the area where the time punching machine is installed. The floor is plane and in a single level. And the wall on which it is mounted^{is} has minimum vibration is favourable both for the machine as well as the operator.

The passage should always be clear of everything. This area, if it is less noisy would be better as the man on watch duty would have clear feed back of the card printing so that the malpracticing could be checked. There should be protection against the rainy and ghasty weather to the time punching machine and the cards.

4.6 . Sociological analysis :

4.6.1 Socio economical: There is yet no compulsion for the use of time punching machine. Yet it is an economical system for the medium to big industries and organisations. As it records the time accurately the remuneration also could be had with a great precision which could be a fair deal between employee and employer. Fraud is minimised, particularly the possibility of one workman clocking on for a fellow-employee, such things otherwise would affect the economy of the industry. The preparation and compilation of wages is facilitated. This is regarded as a costly commodity by the industries of low capital thus this device may be regarded as a sign of dignity and the pride for the industry. Because the attendance and the time is recorded by the workman himself and which he can check for himself makes the monetary transaction fair and peaceful.

There is the saving of one clerk's man power but at a recurring cost of cards and regular maintenance.

4.6.2 Socio-psychological: The automatic control for the recording ensure the impartiality or bias on either side. This promotes punctuality. Creates a no confusion or dispute of attendance and hence ⁱⁿ the remuneration. The best thing is that it brings punctuality amongst the workers. As in many companies everybody punches the card the ordinary worker as well as the manager it brings the equality before the punctuality. A card is like a cheque in which daily the employees are adding some amount and awaits very impatiently for the due date or cashing date. As a system it promises a fair deal and justice to everyone concerned and is ^{a sign} of sophistication and repute for the industry.

4.7. Visual analysis :

4.7.1 The shape of the time punching machine is bulky and the glass panel exposes the space which gives a feeling emptiness. These are contradictory feelings created by the time punching machine.

It does not convey an image of a precision instrument. The dial has got poor graphics and encircling shining framings is not appealing to the eye.

The surrounding of the wooden frame over the top half of the dial shows as if the clock is hanging in the air.

The pendulum looks very heavy and still, so does not stimulate the feeling of swinging, the basic function of pendulum.

The manner the printing handle is positioned, one may sense as if it stabbed in the stomach.

4.7.2 The card is cluttered with data spread all over there are too many lines which divides the surface into small blocks. These dividing lines are too thin so these are very dominating. The formal design is poor and has no aesthetic sense or an organised pattern on the whole. The two coloured printing of red and black on

dirty white surface puts a poor show.

4.7.3 The wooden polished cards racks are attractive when new but later it fades out unequally from the various spots and leaves the patch marks on it. The black enamel painted plates which constitute pockets produce high contrast with frame. When two consecutive pockets are empty, then it is hard to find a line of separation. Due to the similar reason when a full column is empty it would give an impression of single black strip running throughout the height.

5. Hypothesis :

The card storage system and time punching machine should fulfill the following needs:

5.1 Functional :

5.1.1 There should be a device to measure the time and to record the time.

The time displayed should tally with the standard time.

The display of the 'Time' should be continuous.

There should be a provision to record the time on the pre-determined paper-form etc. as per the requirements. There should be a provision or adjustment of the mechanism whenever necessary.

The device should be protected against the rain and weather conditions.

It should be secured against any possible tampering by unauthorised people.

There should be a feed back for the operator as well as the man on watch duty of the completion of the cycle.

It should be convenient for the user to use it and service man to maintain it.

5.1.2 There should be^a specified form to record the time.

The time of different occasion should be recorded in different places. Like 'In' and 'Out'. There should be an identification for temporary and permanent employee.

There should be space for writing the identity of the employee.

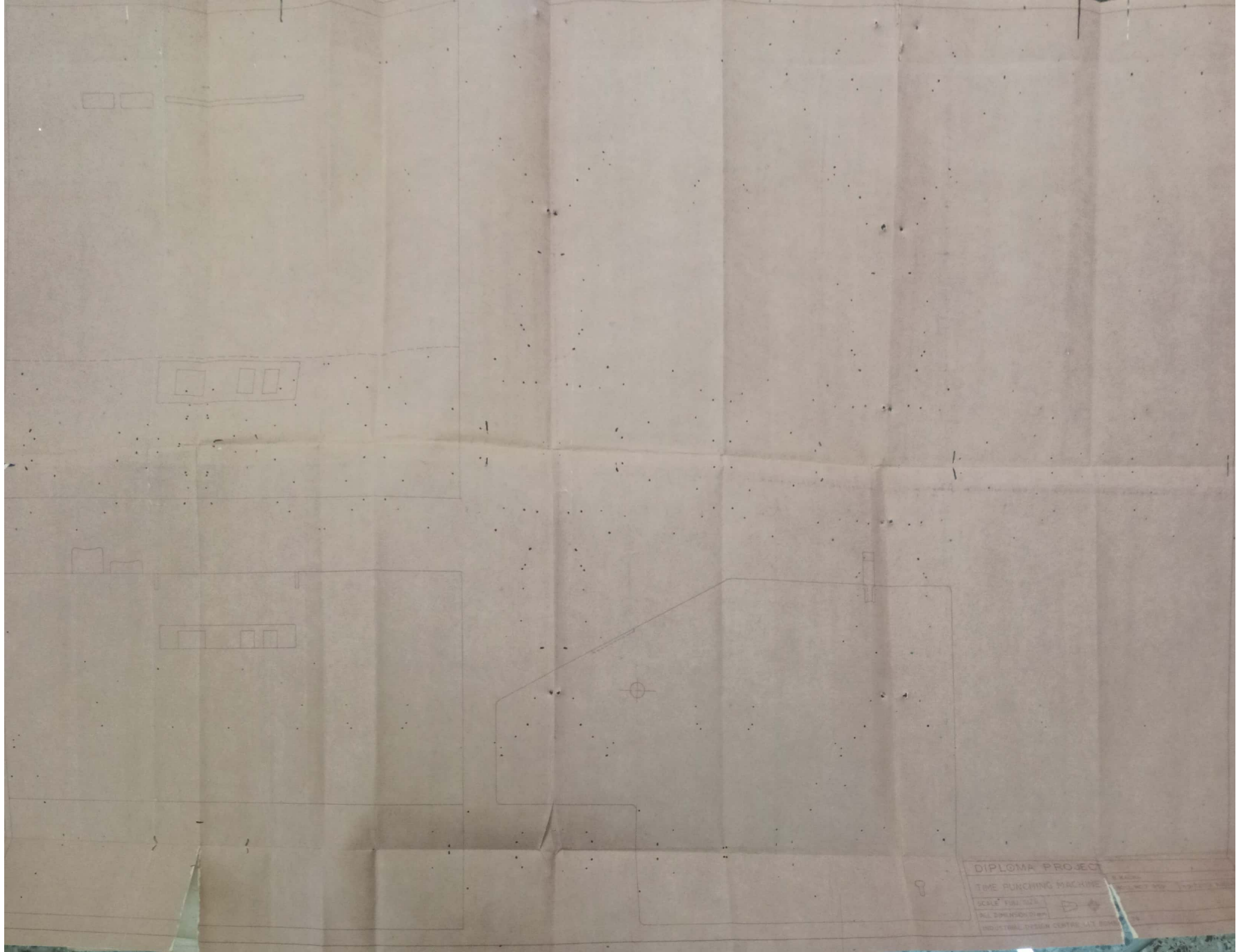
Some provision should be done to write some remarks etc.

It should contain the necessary items like details of remuneration and deduction etc.

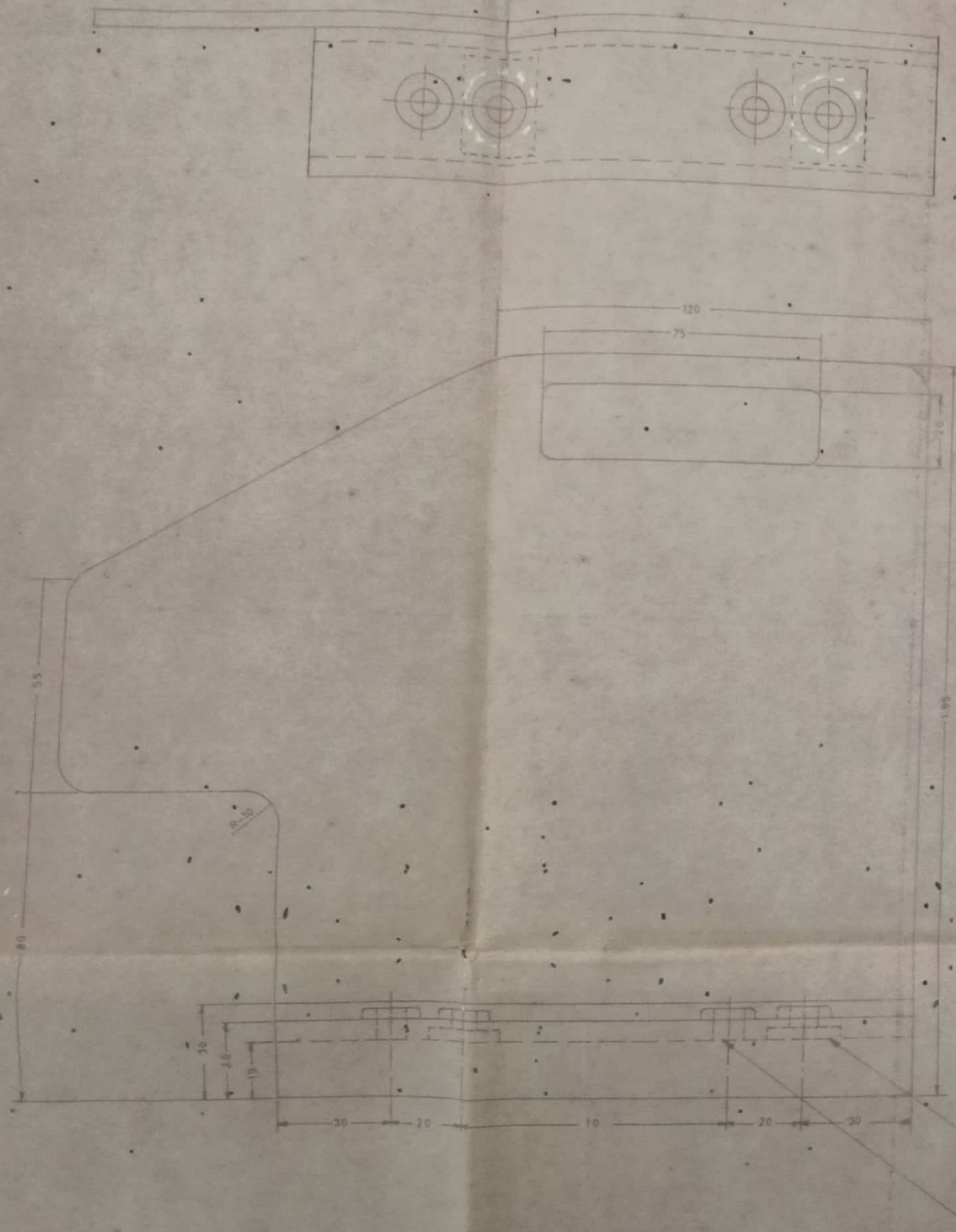
5.1.3 There should be device to accommodate the recording forms.

It should protect the recording form.

There should be a separate housing for the recording forms of each employee.



DIPLOMA PROJECT	
TIME PUNCHING MACHINE	
SCALE: 1/10	DATE: / /
ALL DIMENSIONS IN MM	INDUSTRIAL DESIGN CENTRE, VIT BORDO



DIPLOMA PROJECT

T. P. M/C BRACKET

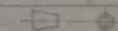
B. KALRA

ROLL NO. F 959

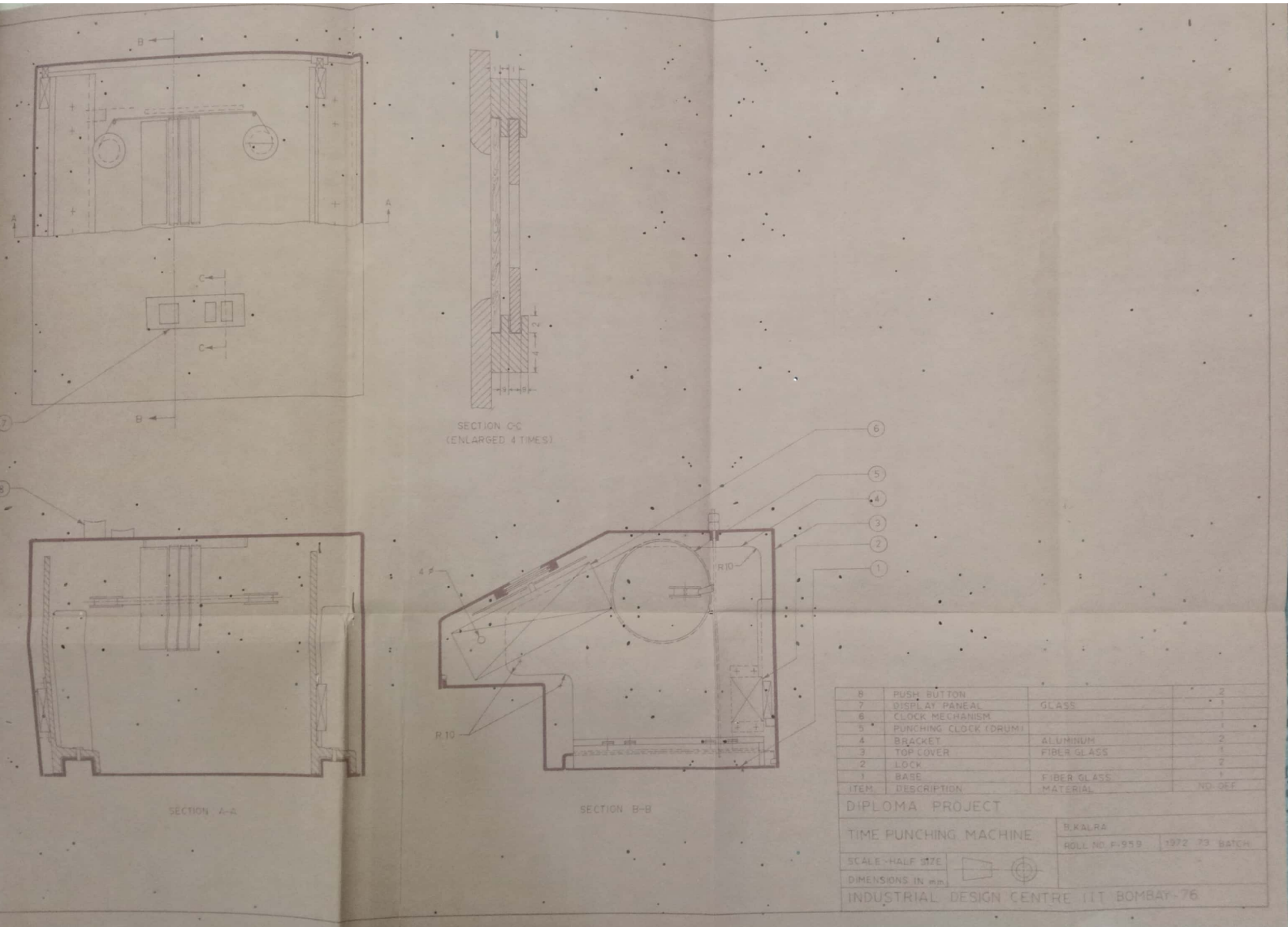
15-72-73 BATCH

SCALE FULL SIZE

ALL DIMENSION IN mm



INDUSTRIAL DESIGN CENTRE, I.I.T. BOMBAY 79



5.2 Structure :

5.2.1 There should be a good support for the whole mechanism or device. It should protect the mechanism against

i) Prevailing conditions of temperature in the surrounding.

ii) The weather and rain.

iii) The vibrations due to the heavy machines etc.

iv) The tempering or any sort of cheating.

v) Damage in normal handling when not fitted to the cab.

It should be easy to install. It should be of light weight and small ⁱⁿ size for easy handling, low freight and transportation cost.

The mechanism should be easily accessible for preventive maintenance and repairing etc.

It should be secured against the possible theft and damage against the misbehaviour of the employees as ^{violating} per moral standing law in strikes and violence.

The housing of the form ^{each} for the employee should be separate from other forms.

This should be installed along with the time punching device. It should be convenient for the user.

5.2.2 The recording form should be compact as far as possible.

It should be of fair quality to stand with the handling of people of different levels with thirty days workman's handling included.

There should be space to record the time of a month for the working hours of the each employee for thirty days.

There should be independent record of each day and for each employee, this factor is the major to decide upon the overall size.

It should be strong to go through the operations of thirty days.

Possibly it should be protected against the dirty spots due to handling.

There should not be any possibility of malpractising by the employees.

5.2.3 The housing device for the forms should be strong to hold the forms.

It should be light weight and compact in size for better handling and transportation.

It should be very simple in installing.

It should protect the form from being flying
away due to fast wind etc.

It should take minimum floor area.

It should be of the material which ^{is} abundant.

5.3 Ergonomical :

5.3.1 As this operated at ^{an} average of two-times per employee per day and with an average load on this device of four hundred employees the frequency of the use is one thousand so it is need to be very convenient and simple to the every operator. So it should be located at convenient height and the operating levers should be designed with ninetyfive percentile anthropomatic data of height, vision angle, elbow height, fore-arm reach horizontally and vertically should be taken in account.

The display should be simple and complete. The legibility of the letters, numbers and type face should be properly chosen for the close and distant readability.

The operational difficulties of the user in rainy season should be solved.

5.3.2 The identity of the employee should be well depicted with proper selectech of type-phase face and size of letters and numbers. The lay out should be such the most important data would be the dominating element. The data filled in should be neat and clean. The form should not slip off the grip of fingers. The

edge should not obstruct the operation of
sotring of the form in its place.

5.3.3 The housing for record form should be installed at convenient height of ninety percentile of the user's height. This should allow the record to deposit and with draw in a swift manner.

The record should retain in its position until it is shuffled by the user. The information whatever it has to display should be perfect.

5.4 Visual :

5.4.1 The device should possess the delicacy and sophisticated look as a measuring instrument.

The shape and size should be suitable for the environment where it would be used. The colour should go well with environment.

5.4.2 The lay out and formal design of the recording form should be well balanced when the data is not filled and when it is not.

It should be like a thing to be possessed.

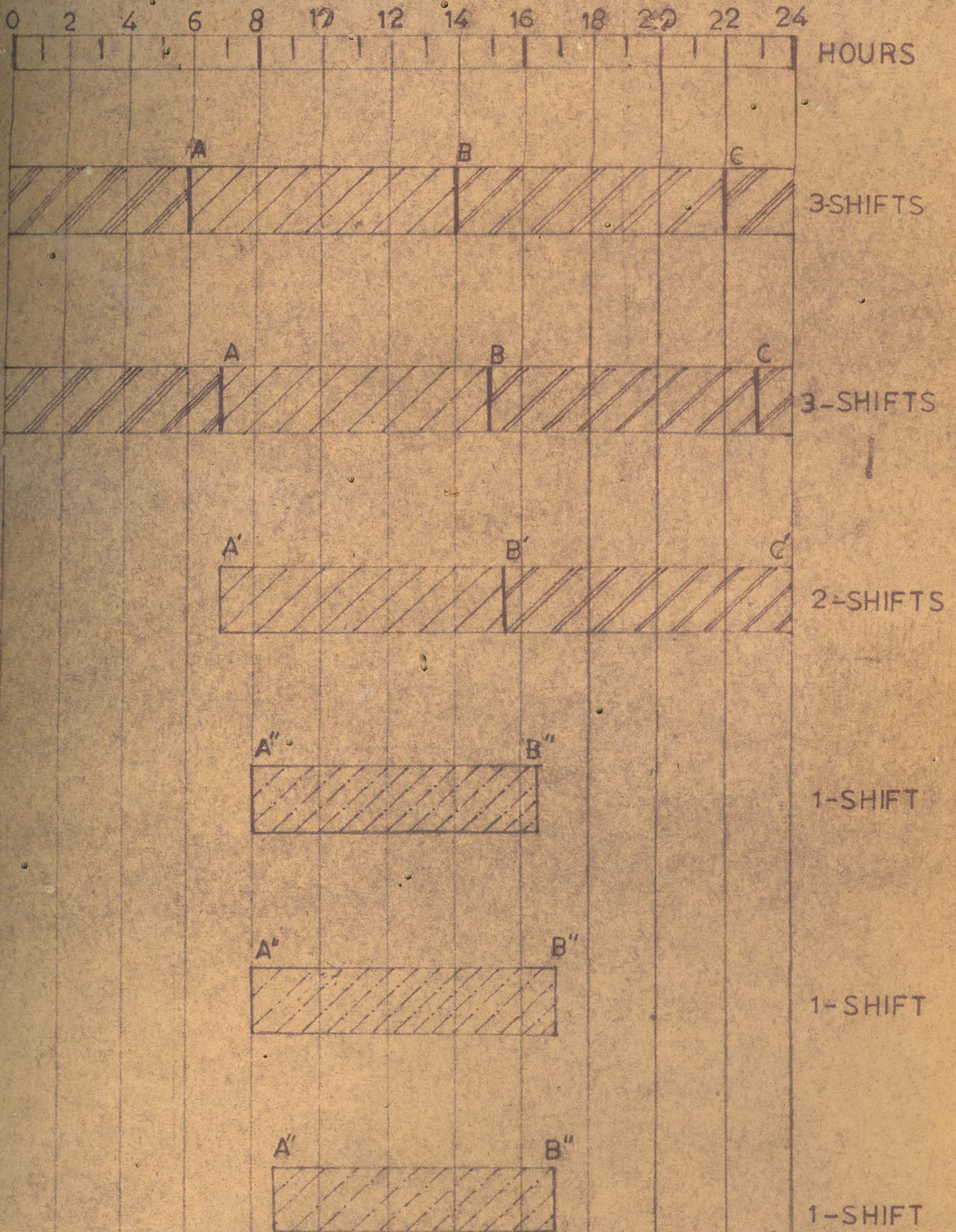
5.4.3 The housing should fit in the environment in shape and colour. The wholeness should be retained either it is full or partially empty or fully empty. And modular system will be more appealing.

There should be a visual balance of the different elements and their integrity should be retained. This should have an aesthetic appeal and industrial look. It should look like a commodity worth possessing, a sign of pride and an item of esteem value.

6. SYNTHESIS

This design was attempted to cover up the requirements of the consumers and manufacturers. In the consumers' list both the industrial organisation and the employee has been given a due consideration. The survey on the users' need has been carried out for small-scale to medium industries of different fields. But because of lack of technical information from the manufacturer's side, I had to limit my design with some feasible assumption and the details of mechanical operation has not been worked out.

SHIFT SYSTEMS

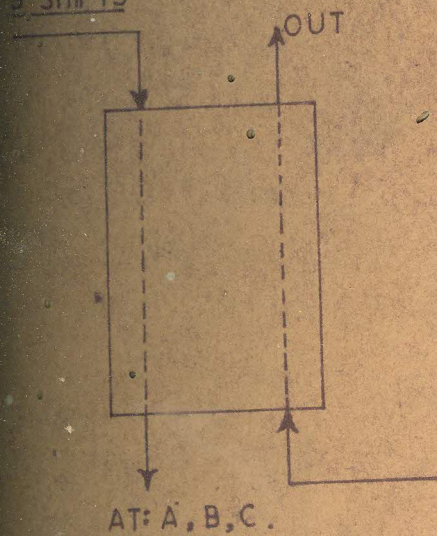


TIME PUNCHING MACHINE

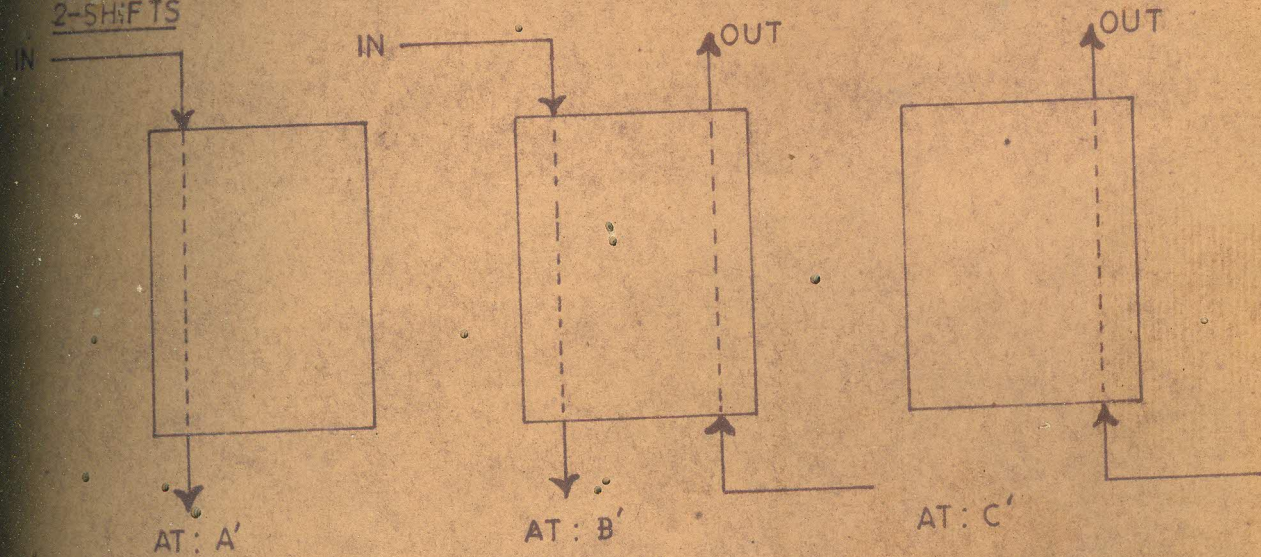
AND

USER

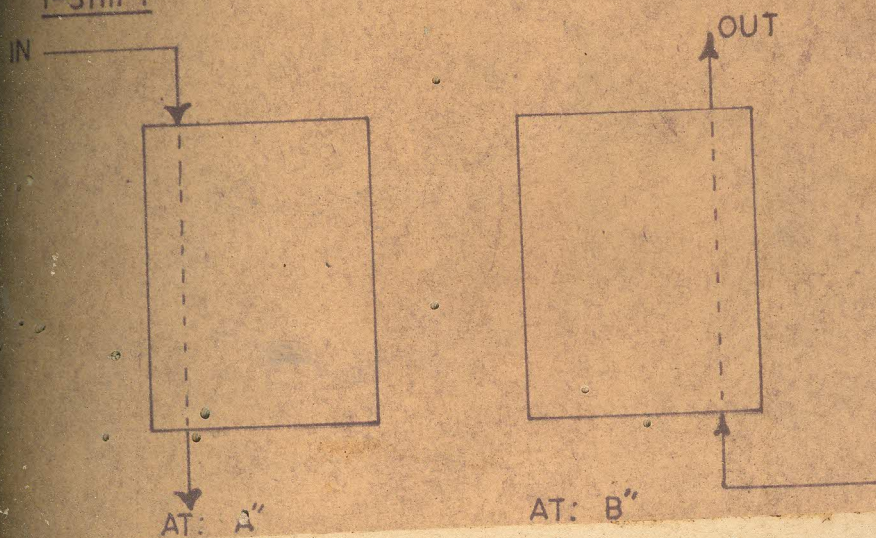
3-SHIFTS

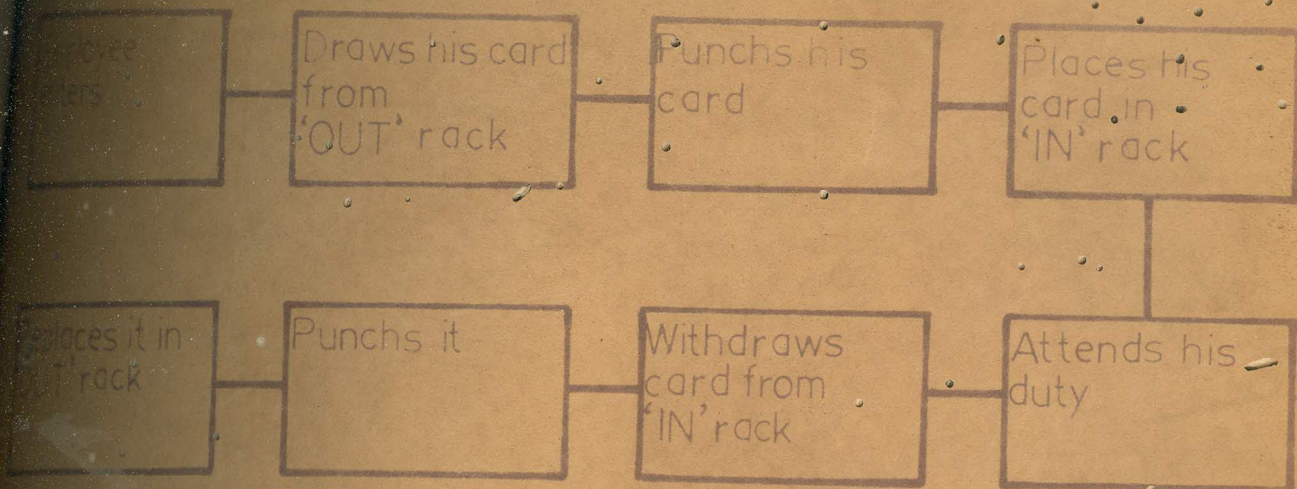


2-SHIFTS



1-SHIFT





CYCLE OF OPERATION

AVERAGE DISTANCES IN METERS AT WHICH NUMERALS OF DIFFERENT
STROKE - WIDTH — HIGHT RATIO CAN BE READ

COLOUR OF NUMERALS	STROKE-WIDTH - HIGHT RATIO							
	1:40	1:20	1:12.3	1:10	1:8	1:6.6	1:5.8	1:5
WHITE	33.9	35.8	36.5	35.5	34.7	33.4	31.4	29.4
BLACK	25.2	28.0	31.1	32.7	34.5	33.1	32.1	39.9

Time Punching Machine :

6.1 Functional

The punching operation of the card has been simplified to a single hand operation ; this is card activated imprint. In a single swing the card is inserted in the slot and pushed further. This push activates the hammer unit which strikes and printing takes place.

The time display is so arranged that the user can see the time at the same instant when he prints card. The digital display has been adopted after the study of dial systems.

As the time punching machine is needed to print in "In" and "OUT" regions almost simultaneously, for example at the change of shift, an easy means of push buttons has been adopted which brings the tape in any selected region to carry out the print.

The clock and the mechanism takes the drive from a spring which is to be wound every week. An alarm bell is incorporated inside this to give a warning for winding the spring. Manual spring winding simplifies the mechanism.

The card is printed with Day's initial and time in the decimal units, adopting six minutes as being equivalent to 01 hours and changing the punching clock say from 7.1 to 7.2 only

after an elapse of six minutes. This decimal system will be much assistance to the wages clerks in calculating monthly hours worked by any worker and the remuneration thereof. This would reduce the cost^{of} printing clock as it would have only 10 pairs of 0.0 to 0.9 hours for example 5.1 the above one for 'IN' and the lower one for 'OUT' prints 5.1.

6.2 Structural

The time punching is a costly commodity. It has an esteem importance. It has a long life. It is manufactured as a batch product. So the possible material and process for making is plastic, vacuum forming, fibre glass or metal fabrication.

Taking other factors also into consideration like life time, stability and maintenance etc. the fibre glass has been selected.

As an outer structure the time punching machine has two parts, the base and the top. These are designed to accommodate the mechanism safely but firmly and protects it in normal handling and use. The details are shown in the drawings. The pigments are mixed with resin.

The whole mechanism is mounted on two castings. These castings has two slots on the top edge which makes the handling easier. These brackets are mounted on the four rubber bushings prelocated during the moulding of the base.

There are two locks which are screwed to the brackets and could be operated from outside. These prevent the pulling out of the top, when these are locked. This prevention is possible due to the strip which is fixed to

bottom edge of the back. A similar strip on the front face bottom also fixed. These two strips locate the seating for top cover. There are two slots for the grip in lifting etc. on the base.

Appropriate slots for card inserting and time display are located on the top mould. The window is covered with glass sheet. The provision for ~~push buttons~~ ^{push buttons} is made to accommodate and for winding the spring from outside.

6.3 Maintenance

The maintenance demands an easy access to every part. The change of tape and minor maintenance may be carried out on the user's place or for major maintenance the time punching machine may be carried to the workshop. These requirements are fulfilled by designing the top in such a way that this could be pulled out easily after unlocking it from the base. When the cover is replaced automatically gets repositioned due to the two strips which are fixed one each on the front and rear.

The two slots on the brackets provide easy

handling in workshop while assembling or maintaining the machine.

6.4 Location

Every industry is different from another in plan and layout. So it is hard to specify a definite place or location of the Time Punching Machine. The recommended location is (i) the vicinity of the time office so that the idle walking time between time punching machine and the office would be minimised besides a watch could be kept for observing the proper functioning of clock, machine. And a check on any sort of mal-practising or tampering may be done.

(ii) The passage which leads to main entrance of the plant building through which maximum people pass while entering the plant. In these locations there would be the protection *against sun, rain and wind and better security.*

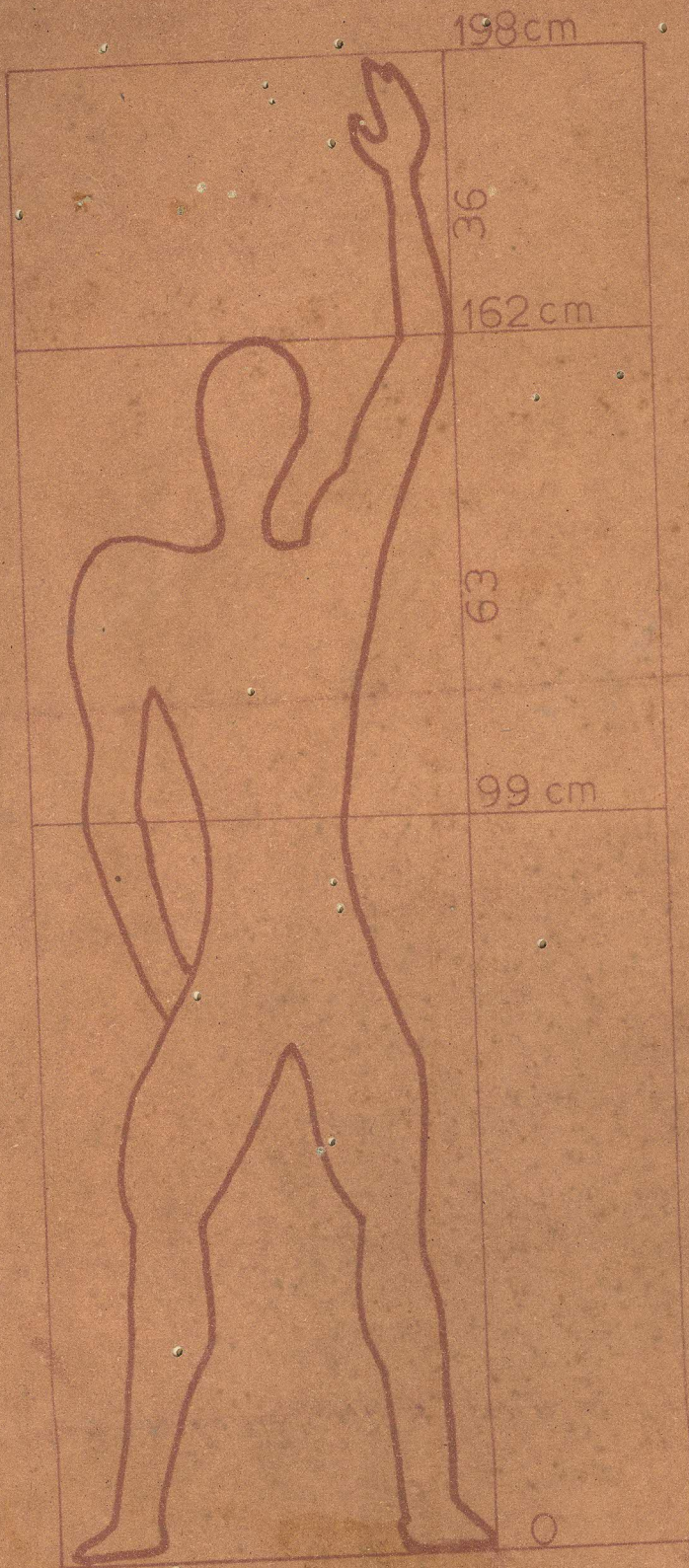
(iii) The last preference is, the entrance gate under the supervision of the security guard.

6.5 Installation

The time punching machine is to be installed on a wall which has no or minimum vibrations. When no such wall is available a stool like support is to be erected from ground level on which this machine is to be installed. For installing an angle bracket is chosen, one side of the angle is fixed (nailed) to the wall. The time punching machine is to be supported on the other side which has got slots. The Time Punching Machine is to be screwed down through these slots and the corresponding holes in the brack casting of the mechanism.

6.6 Security and protection

The appropriate location and proper installation furnishes optimum security against the theft and protection against wind, sun and rain. To safeguard against the any possible tampering, the top cover is locked with the base.



6.7 Handling and transportation

The whole unit is compact and handy. It is easy for handling and transportation. The fibre glass body is strong to support the entire internal mechanism and bear with the transportation prior to sell and post-sell maintenance etc. The slots in the base and slots in the casting facilitate the handling. For safety of the man and machine the handling by two men is recommended.

6.8 Ergonomical

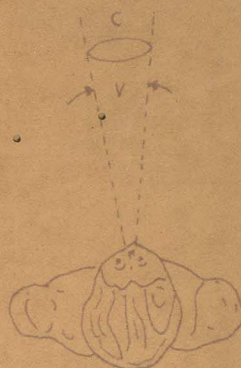
The time punching machine is to be installed in such a way that the top face where the card is to be inserted is at the height of 100 cm.

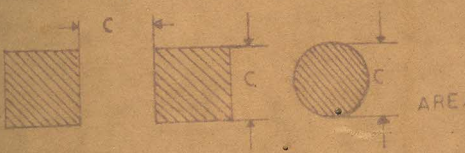
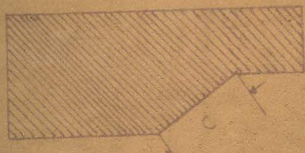
The time display is such that while the user comes close to the time punching machine, he can observe the time and as well as when punches the card. The number recommended are universe condensed extra bold.

The push buttons are situated at the left so that these may be operated with the left hand and card being held with right hand may be half the way inserted in the slot.

V-VISUAL ANGLE

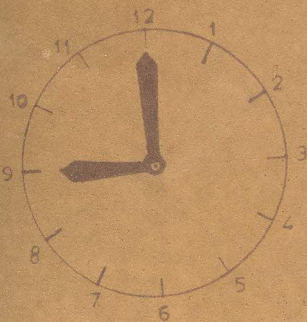
C-CHARACTER
DIMENSION
AREA



CATEGORY	MINIMUM VISUAL ANGLE OF NORMAL VISION	DIMENSION OF 'C' IN INCHES AT NORMAL FIXED DISTANCE F.D.=15"
 AREA	1.0	$C = 0.00436$ USE $C = 0.0044$
 CONTOURS	12.0	$C = 0.00087$ USE $C = 0.0009$
 LINES	3.0	$C = 0.00022$ USE $C = 0.0002$

THE FOLLOWING ARE THE ILLUSTRATIONS OF PREFERRED PRACTICES
IN THE PRINTING OF NUMERALS.

For fixed dials with moving pointers position numerals
horizontal to line of sight, not radially



PREFERRED

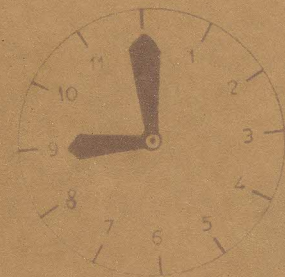


POOR

If space is not limited it is desirable to place the
numerals outside the scale markers to avoid having
numerals obscured by pointers. (if there is any
restriction at all on space, however, it is usually
desirable to place the numerals inside the markers
in order to have the scale as large as possible)



PREFERRED



POOR

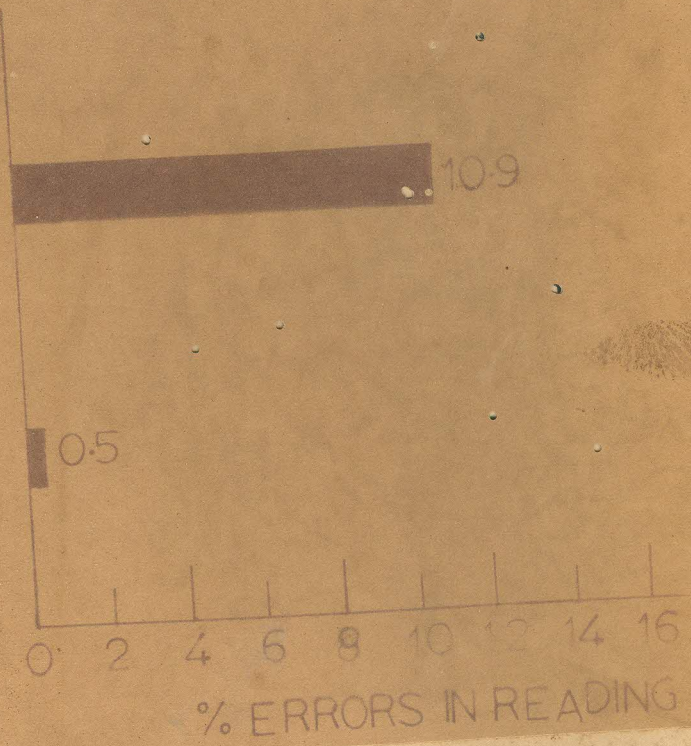
PER CENT ERRORS IN READING DIFFERNT DIALS



(i) ROUND



(ii) OPEN-WINDOW



Illustrations contd

For open - window dials.
Numerals should be placed to appear
right side up when exposed.



PREFERRED



POOR

The IN and OUT plate is anodised with type face of 24 pt. universe medium.

The print size for the card is 8 point universe medium, but expanded (opposite to condensed).

This ^{is} assume^{that} the card is to ^{be} read from a close distance of 20 to 35 cm. (book reading) distance. Minimum projection 18 mm is provided for card grip when the card is to be printed in the top most line. Everywhere working radii are adopted.

6.9 Visual

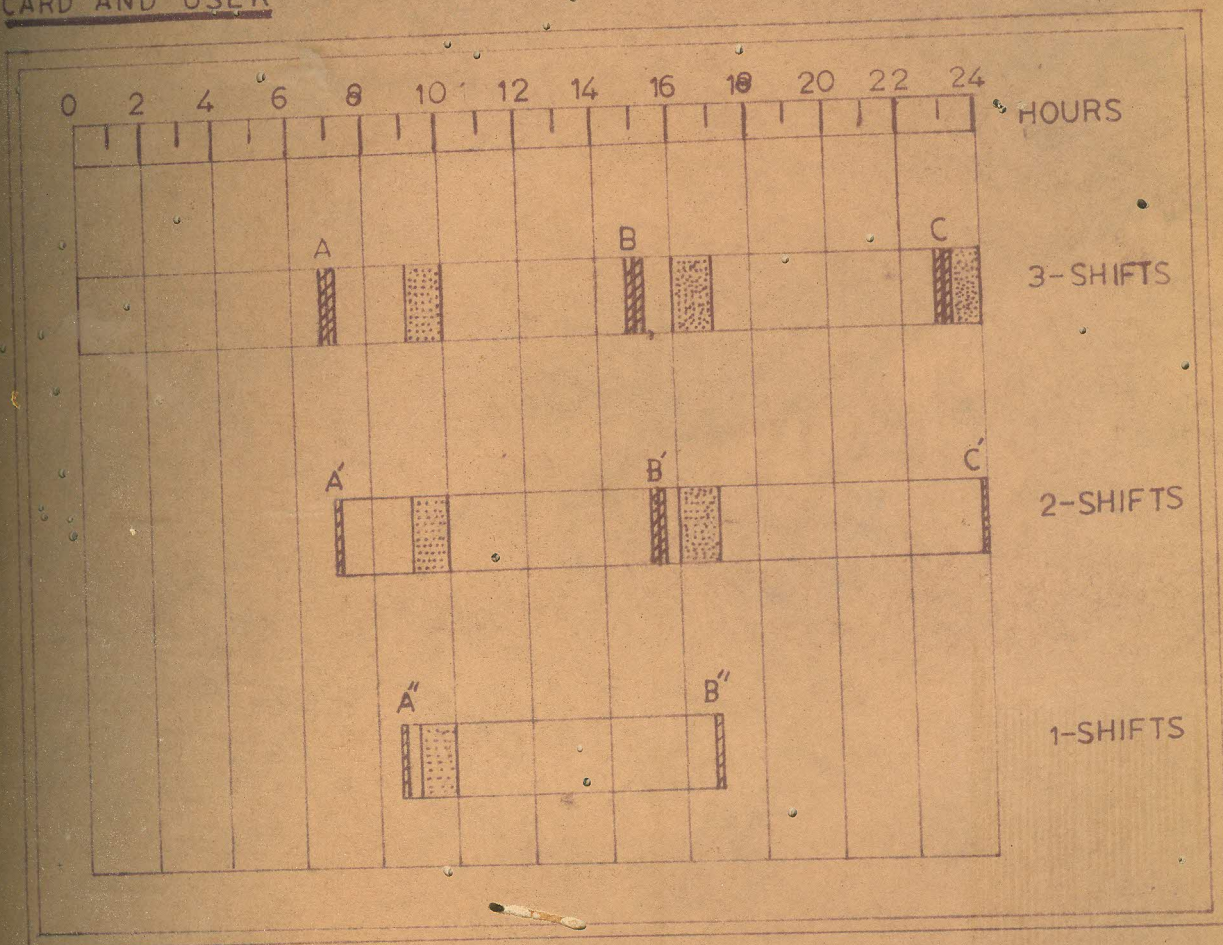
The shape is chosen such a way that it follows function like making provision for punching card and displaying time.

The layout of the slots and window is such that both look like as these belong to the same category.

The push buttons are prominent.

The colour of the body is chosen so that it would suit the industrial environment and give an appeal of precision instrument. This may be marketed on two to three ranges of colours.

CARD AND USER



EMPLOYEE



TIME OFFICE MAN



CARD STORAGE SYSTEM

This has been designed after the detailed and subjective study of the user.

It has been observed that generally there is queue for punching the card, so there is some time for the user to select his card. If it is kept in order, it has been found those who can read out their numbers had almost no difficulty and the progress of the queue was not hampered ~~at all~~. But when it was experimented on a group which was completely illiterate who has been identifying the card with some spot or mark, took little longer.

But keeping ^{in view} the checking ^{time} at the outer gate, and time taken in this is ^{permissible} ~~enough~~ ^{instead it prevents} which results in a mass or mob rushing for the gate.

So, the card storage system has been suggested instead of the present card display system. It is of great help to the time office clerk who can carry the racks to his table instead of plucking out card and replacing these back. Thus a lot of saving in time & effort would be done.

Due to rough and frequent handling, strong and cheap material like wood has been selected.

The shape is designed to fulfill various requirements like classification of cards, ease of handling and convenience of the user.

CARD

The card has a provision to record the time "In & Out" and space for printing day's initial. There is a second column which could be used by those who go out while on duty. For them a hand entry has been resorted which the supervisor/the security or the user himself may enter depending upon the individual organisation.

The card has been exclusively designed for time office performance and the employee's use only.

No.

NAME _____

DEPARTMENT

197	1	2	3	4	5	6
MONTH	7	8	9	10	11	12

[illegible]

INDUSTRIAL DESIGN CENTRE

No. _____

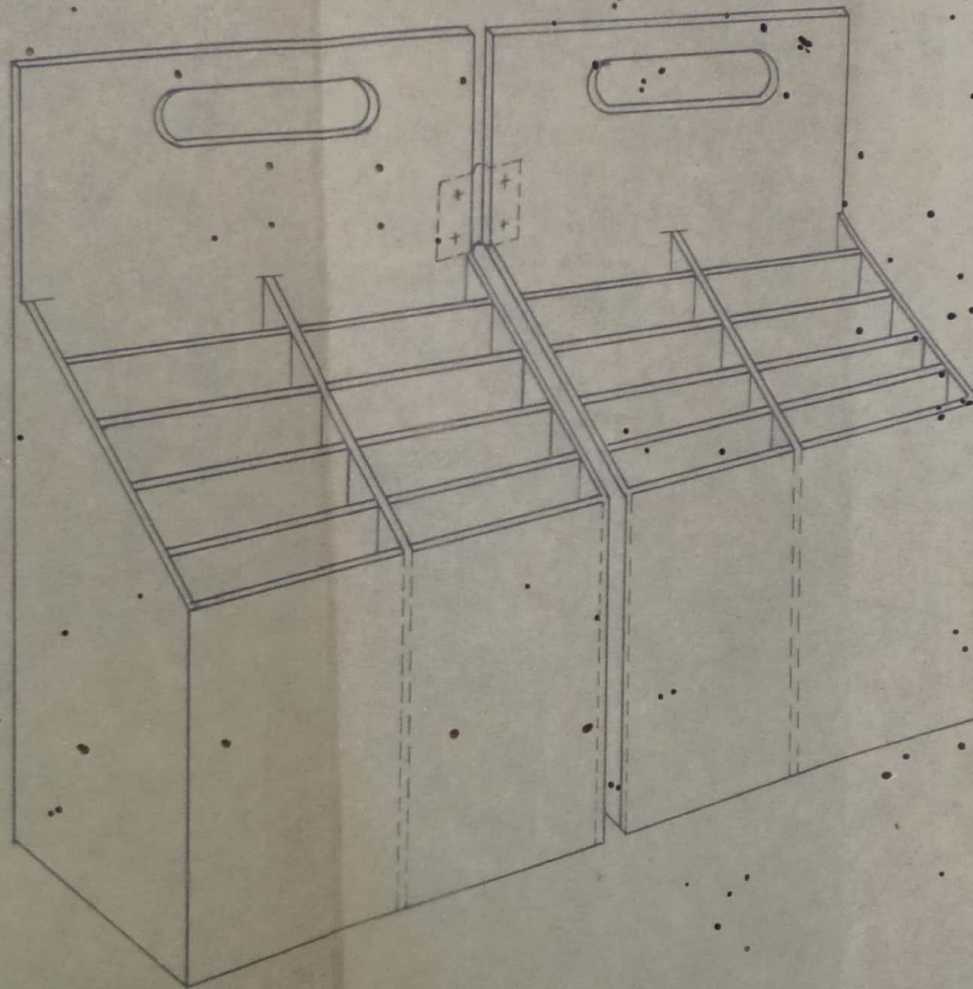
NAME _____

DEPARTMENT

[illegible]

INDUSTRIAL DESIGN CENTRE

Communication :



DIPLOMA PROJECT

CARD STORAGE

SCALE NONE ↑

INDUSTRIAL DESIGN CENTRE

B. KALRA

1972-73 BATCH F-959

BOMBAY

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5. **Work design System concept, by Nadler, Richard D. Irwin Inc., Homewood, Illinois.**
6. **Human Engineering, by E.J. McCromick**
7. **Work Factor Time Standards, by J. Quick, Duncon, Malcolm McGraw Hill Book Co. Inc., N.Y.**
8. **Ergonomics vol.6, 1963 issue.**

Appendix

Following are the places where the detail study of 'Time Punching Operation' was carried out.

Empire Dying, Mahalaxmi, Bombay.

Devidayal Stainless Steel India Pvt.Ltd.,
Kanjur Marg, Bombay.

IBM World Trade Corporation, Andheri, Bombay.